FINAL REPORT

SPECIALIZED FORAGE (TIMOTHY HAY) SYSTEMS IN A.D.D. #12

19970422

August 2001

Prepared by: District #12 ADD Board

AGRI-FOOD INNOVATION FUND

Canada

Saskatchewan

Specialized Forage (Timothy Hay) Systems in A.D.D. #12

PROJECT #97000422

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1998 Activities

Background:
In the fall of 1998, Sunridge Forage from Russell, Manitoba started purchasing timothy hay from local producers primarily for the Japanese dairy industry. Due to low commodity prices in the northeastern area of Saskatchewan and the attractive returns from the timothy hay industry, many producers have seeded timothy. In 1998, approximately 35 producers in Saskatchewan seeded over 3000 acres of timothy hay for the densified hay industry. Unfortunately, there is relatively little technical information for producers about timothy hay production. A.D.D. Board #12, Ducks Unlimited and A.F.I.F. have initiated trials in 1998 to help provide the missing information about basic agronomics on growing timothy for the densified hay industry.

Activities:

Herbicide Minor Use Registration
To address the lack of current information on herbicides registered for seedling timothy in the establishment year, ICMS from Portage La Prairie were contracted to do a trial on 8 herbicides (grassy and broadleaf) at normal and two times the normal rate on timothy seedlings. ICMS set up the plot, applied the herbicides, and evaluated the results at 14 days and 28 days after application. ICMS have provided this data to A.D.D. Board #12 and this information will be used for minor use herbicide labeling. This is one of three site years of data required for the registration for minor use. In 1999, yield data will be collected from the trials established in 1998. In addition, Agriculture Canada (Melfort) has indicated they will be able to collect the additional two site years of data in 1999. Therefore, the only money required for this portion of the Timothy Project in 1999 will be for the yield collection on the trials initiated in 1998.

1998 Cost $3731.09

Variety Testing
Saskatchewan Forage Council were contracted to collect the yield data on six varieties of timothy from Transfeeder, Alberta. The varieties of timothy tested were provided by the industry and were felt to be the most current varieties used by producers as well as two varieties the industry felt had potential in northeastern Saskatchewan. In 1998, SFC seeded the variety plot and data is to be collected in 1999.

1998 Cost $600

Fertility Work

To address the fertility requirements for timothy, fertility trials were developed to determine the nitrogen, phosphorus, and potassium (N, P, and K) requirements for timothy. In 1998, the East Central Research Farm (Ag. Canada) from Canora were contracted to seed and intitate trials to determine timothy hay yields based on different rates of N, P, and K. In 1999, ECRF will reapply the annual rates of fertilizer and yields will be collected from the plots.

1998 Cost $2000

Companion Crop Study

To determine if companion crops used at the time of seeding, can effect the yield from timothy in subsequent years of harvest, a study was designed using 8 different seeding rates and types of cover crops to be seeded with timothy. Yields would be collected in 1999 and 2000. Due to dry spring at the Saltcoats site, seeding was delayed until proper weed control could be achieved with the Roundup herbicide. This delay in seeding was too excessive for the seeding of an annual cover crop (June 24) and rather than initiating a non-representative trial, this study would be delayed for one year. Note: This trial was initiated by ECRF at a second timothy learning site at Buchanen on Ducks Unlimited land.

1998 Cost $ 0.00

Other Activities:

- At the timothy site in Saltcoats, the Saskatchewan Soil Conservation did a trial showing the "Do's and Don'ts" of Zero tillage seeding of timothy. (SSCA cost)
- A dormant seeding trial (seeding in late October) to show different seeding dates and there viability was initiated at the Saltcoats site (Ducks Unlimited Cost)
- To show field scale timothy hay, approximately 35 acres of three different varieties (early, medium and late maturing) of timothy were seeded on the Saltcoats and Buchanen sites. The field scale trials will be utilized in future years for harvesting demonstration (Ducks Unlimited Cost)
- Timothy was seeded on two 17 acres plots on different soil types in the Rural Municipalities Esterhay #184 and Garry#245 to demonstrate the potential and yield of timothy hay in their local area (Ducks Unlimited Cost)
- Signage, two 4'x8' signs were designed and erected in 1998.
- Field day: On October 14, 1998, approximately 30 producers attended a field day held on the Saltcoats site. The field allowed producers and Ag. industry to see timothy at the seedling stage, ask questions of the industry and see a newly developed hay re-conditioner used in timothy hay production.

Specialized Forage – Densified Timothy Hay

1999 Update

Due to a very successful establishment and over wintering for 1998, the timothy hay project was able to provide some preliminary results in 1999. Part of the A.F.I.F. funding is to research timothy varieties (six), fertility requirements of timothy (nitrogen, phosphorus, and potassium), and the performance of a hay re-conditioner for harvesting. In addition, a new trial was initiated on the timothy sites to study the differences in forms and methods of application of fertilizer (liquid vs. dry, broadcast vs. coultered).

There were two field days held in July of 1999 on the timothy demonstration site in Saltcoats. One day was for agriculture extension and industry and the second for current and future timothy growers. Approximately 15 professionals attended the first field day and over 40 producers attended the second day.

To date, there are approximately 50 producers growing over 6000 acres of timothy in northeastern Saskatchewan.

Specialized Forage – Densified Timothy Hay

2000 Update (Year 3)

In the last year of the project, initiated trials in year 2 were continued into year 3. The trial studying yield response to the three main nutrients; nitrogen, phosphorous and potassium were repeated. Based on the results from the in year 2 trial – Different Fertilizing Methods and Forms (liquid vs. dry, broadcast vs. coulter) showing no differing yield responses, there was no need to repeat the same trial in year 3. In addition, the leased Ag Shield Hay Reconditioner was utilized and evaluated by 11 producers who reconditioned approximately 2900 acres of timothy during the last two years.

A field day was held on July 10, 2000 with approximately 55 producers, professionals and industry representatives in attendance. The goal for the day was to present the data from the trials, display equipment, answer questions, address management concerns and to develop a confidence in the densified timothy hay industry.

Review of the Ag Shield Reconditioner Unit

Background

Densified timothy hay is a specialized crop in the Yorkton area that can provide producers a gross return of up to $500/acre. The industry requires producers to harvest and bale timothy hay at approximately 12% moisture in order to minimize the risk of the compressed bale to become moldy. In addition, the industry requires the timothy to retain its "celery" green coloring. Once harvesting commences and the timothy is drying in a swath, the timothy is susceptible to bleaching from the sun and rain damage. The quicker the timothy hay reaches the critical 12% moisture content, the quicker the hay can be baled and put under storage. To assist the drying time of cut timothy hay, Ag Shield Manufacturing from Benito, Manitoba has developed a new crimping/swath inverting machine. The Recon 2000 has the ability to crimp the hay at many points along the stem with minimal damage to the timothy seed head. In addition, the Recon 2000 is able to invert and redirect the timothy swath onto new dry ground adjacent to the original swath. The timothy industry advocates to its producers the use of this specialized equipment. However, due to the expense of the Ag Shield Recon ($11,500) and the relatively short time the equipment has been available, timothy producers were reluctant to purchase the Ag Shield Recon units.

Objective

In order for producers to consider investing any additional capital into timothy hay production, producers must have access and the opportunity to utilize specialized hay drying equipment. The A.D.D. Board was able to lease an Ag Shield Hay Reconditioner for three years and made it available to timothy growers. By providing an opportunity to timothy hay growers to access a hay reconditioner, producers will be able to see the merits of the specialized equipment and determine any of the equipment's shortfalls without the expense of owning the equipment.

Results

For ease of operation and to maximize the exposure of the Ag Shield Recondition Unit, the A.D.D. Board decided to allow one producer (Larry Konan) coordinate the movement and scheduling of the Reconditioner to producers. The producers had the option of allowing either Mr. Konan recondition the field or to allow the producer to utilize the equipment themselves.

In 1999 and 2000, the Recon 2000 was used as follows:

1999 Recondition Use

Recon Serial # 1899217 (Konan) ADD Board
Location: Rokeby Konan's Yard
Damage: Hinges need welding, vibrates

Name	Acres
Larry Konan	380
Todd Sharpe	200
B. Nussbuamer	100
Bob Cumming	60
Hudson Walker	60
Leonard Krepicavich	80

2000 Reconditioner Use

Recon Serial # 1899217 (Konan) ADD Board
Location: Ducks Unlimited Compound
Recon 2000
Unit # 1899217

Name	Acres
Larry Konan	380
Donny Sharpe	130
Todd Sharpe	280
Hudson Walker	70
Dave Lukash	130

By far the most common comment from producers who used this equipment was the frustration the equipment caused due to the amount of breakdowns. Producers did believe the equipment did improve the amount of time it took for the timothy to reach 12% moisture. Producers noted Re-conditioners did not harm the quality of the hay and in some circumstances; the re-conditioners were able to improve the grade of product. However, the hinges of the wings were made with too light of material to withstand the field conditions or the speed at which the re-conditioners could operate. The wings role is to invert and re-direct the timothy hay onto dry ground, a critical operation to facilitate the drying of timothy. Constant welding and bracing was

employed to ensure the wings, could handle the weight of the swaths and the timothy hay field's conditions.

Conclusions

Producers who used the equipment were able to see the merits of the Recon 2000. All producers recognized the ability of the re-conditioner to facilitate the drying time of timothy hay. Producers have become aware of the importance of the color of timothy with regards to grading and payment. Producers know the Recon 2000 was able to minimize the risk of weather to their timothy crops and access to a reconditioner is required for timothy hay production. Producers were also able to learn about the limitations of the re-conditioner. Timothy field must be very smooth and speed of operation must be lowered. Producers were able to discuss and see the wing assemblies of the reconditioners must be either re-designed or the strength enhanced. Through this project, producers gained experience and saw the importance of the reconditioners in timothy hay productions. Producers were able to gain the confidence through accessing the Recon 2000, to assist in their decision in purchasing their own equipment. Since the fall of 2000, three timothy growers have purchased their own Ag Shield Hay Reconditioners.

Communications

To transfer the information gathered through the project, results will be made available to local extension agents, the timothy hay industry and to producers involved in timothy hay production. With the cooperation from Ducks Unlimited, all timothy hay producers have been tracked in the Yorkton area. This database will be utilized to provide information on timothy hay production. In addition, timothy hay has been incorporated into the East Central Research Station site. This site will be utilized as part of the station's field tours and will provide an opportunity to provide additional information to existing and new timothy hay producers in subsequent years.

Personnel:

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Dr. Wen Chen	Agriculture Canada
Mr. Lynden McFarlane	Agriculture Canada
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Ms. Rosalind Arndt	District 12 A.D.D. Board
Rachel Oystryk	East Central Research Foundation
Ernie Patrick	Saskatchewan Agriculture and Food
Bob Adamson	Transfeeder Inc.

Innovation Fund Acknowledgements

Through the term of the Specialize Forage (Timothy Hay Systems) in A.D.D. #12, the Agri-Food Innovation Fund was acknowledged through various means. At the 3 on-site tours and 2 off-season seminars, the A.F.I.F logo was present on all written reports as well as verbally recognized. In addition, the 120 acre demonstration site had the AFIF logo on the two 4' x 8' highway signage. As part of the final technical report, Agriculture Canada included and acknowledged the Agri-Food Innovation Fund.

PRODUCTION OF TIMOTHY FOR COMPRESSED HAY

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Funding for this research was provided by the Ducks Unlimited of Canada, Saskatchewan Forage Council, Agri-Food Innovation Fund and AAFC Matching Investment Initiative.

Introduction

There are currently approximately 100,000 acres of timothy grown on the Prairies for the compressed hay market. The bulk of the compressed timothy is sold to Japan. This is a lucrative and growing market. Canada's main competitors in this market are the western United States and Australia. Production in western U.S. is constrained by competition from other high value crops and other land uses. Consequently, the Canadian Hay Association is predicting an increase in production of timothy for compressed hay to 400,000 acres in the near future. Strict quality standards are required in the market, including the presence of long heads, green colour, and freedom from *Agropyron* spp and other grassy weeds. Research conducted under irrigation at Swift Current and Outlook has shown that variety selection and management are important in terms of both production and quality. There is very little information on variety performance, agronomy or weed control under dryland conditions particularly for the Parkland region of western Canada. Timothy hay provides both direct and indirect opportunities for diversification. Several Parkland communities have already invested in compressing plants. Improving production levels and quality would ensure that Canadian producers and companies could compete in this market.

A three year study was initiated at sites in northeastern and eastern Sask. Objectives were to: 1) evaluate production potential of available varieties and; 2) develop management practices for establishment, fertilizer management and weed control.

Study description

Experimental Sites

Trials were conducted at Melfort, Carrot River and Star City in northeastern Sask, and Buchanan, Saltcoats and Canora in eastern Sask.

Variety evaluation

Variety evaluation trials were established in 1998 at Melfort, Canora (two trials, designated S and N) and Saltcoats. Land was summer fallowed for several years at Melfort prior to the experiment, at Saltcoats, timothy was seeded into standing stubble and land with previous year barley crop at Canora. Plots were sown in Mid-May 1998 with seeding rate of 1 kg/ha and 12 inch row spacing. 75 kg N/ha was applied in the fall. In the fall of 1999, 35, 20 and 35 kg/ha of K, S and P were also applied. Weeds were controlled each year with curtail M and 24-D.

Six varieties were included in the evaluation, Drummond, Bottnia II, Goliath, Motim, Farol and Timfor. Forage yields were taken at all sites and head length data were also collected at Melfort and Canora S in 1999. Forage yield, head length, and leaf, stem and head percentages were measured at Canora in 2000. There was only one cut made for all varieties evaluated.

Establishment

Establishment trials were set up at Melfort and Buchanan in 1998 to investigate the effect of companion crops on the establishment and yield of the timothy. Treatments were no companion, oats at ½ seed rate harvested early for green feed, oats at full seed rate harvested early for green feed, oats at ½ seed rate harvested for grain, oats at full rate harvested for grain, polish canola at ½ seed rate, polish canola at full seed rate, peas at ½ seed rate and

peas at full seed rate. Timothy cv. Drummond was used for the trials.

The 1998 trial at Melfort was not successfully established due to strong weed competition and lack of weed control options. The 1998 trial at Buchanan was successfully established on land with fallow. Land was sprayed with Roundup and harrowed prior to the establishment. Timothy cv. Drummond was directly seeded with Seed Hawk Air Seeder with seeding rate of 4 kg/ha and 11 inch row spacing. Maintenance spraying for weeds control was done July 13 1998. The plots were sprayed with Banvel and MCPA. A forage cut was taken in mid July, 1999 at 10% flowering stage.

In 1999 the similar trial was repeated at Melfort and was successfully established. The trial was seeded to land with two years barley crop and then summer fallow prior to establishment. The land was cultivated at a depth of 4 cm on May 25, 1999 and then harrow packed immediately. Seeding was done May 27, 1999 using a 3 point hitch plot seeder mounted with knife type hoe openers set at 30 cm apart. On row wheel type packers were also mounted on the seeder. Timothy cv. Drummond was used at a seeding rate of 2.2 kg/ha.

Maintenance spraying for weeds control was done June 28, 1999. The plots with oats as a companion crop were sprayed with Curtail M. The plots with canola as a companion crop were sprayed with Lontrel. The plots with peas as a companion crop were sprayed with Tropotox Plus. The plots with no companion crop were sprayed with Curtail M mixed with Achieve 80DG. A forage cut was taken in late July 2000. Leaf, stem, and head percentages, and head lengths were determined.

Fertilizer management

Fertilizer management was investigated through the establishment of trials on deficient soils. At Buchanan and Saltcoats, N, P and K trials were established. Trials were also established at Carrot River (P and K) and Star City (N and S). Measurements including forage yield, leaf, stem, head percentages and head lengths were taken in the year after establishment at all sites except for Carrot River where two years data were collected. Basal nutrients were applied to all plots except for test nutrients at each site each year.

Weed control

Herbicide tolerance trials were carried out at Melfort on seedling and established timothy stands. Data on the effect of herbicide application on forage and seed production were collected. For seedling timothy, herbicide treatments were applied in 1998, seed harvested in 1999. New trials were established and herbicides were applied to the seedling stand in 1999, seed harvested in 2000. For established timothy, herbicide treatments were applied in 1999 and 2000 on separate areas of the fields which were established in 1998. Seed harvested in the year of the treatment application.

Results

Variety evaluation

In 1999, Goliath had the highest forage yield among the varieties being evaluated at all sites. Goliath and Drummond were significantly longer headed than the other varieties. Data collection was only taken at Canora site in 2000, Yield in Goliath was significantly higher than other varieties and there were no differences in yield between other varieties. (Table 1 and 2).

Establishment

In 1998, a relatively low weed density was observed in the trial established at Buchanan. The "no companion" treatment produced the highest forage yield in 1999. The oat companion crop had a greater suppression of forage yield than the other companion crops (canola and peas), especially for the treatment at full seeding rate. (Table 3).

In 1999, this trial was established in Melfort where a higher weed density than at Buchanan was observed. Highest forage yields in 2000 were found for pea and canola companion crop treatments. Again using oat as companion crop reduced forage yield, with the exception of the half seeding rate cut for green feed (Table 4).

Companion crops had no significant effect on other characters measured at the two locations (i.e. leaf, stem and head percentage, and head length).

Fertilizer management

a. Nitrogen

Significant yield response up to 40 kg N/ha at Buchanan and up to 80 kg N/ha at Saltcoats, was recorded in the first year after the establishment (Table 5). There was a tendency towards yields

decline at N applications of 160 kg/ha or more. Head length generally increased with increasing N up to 80-120 kg N/ha. Stem percentage decreased at rates of 120 kg/ha or more. In 2000, significant yield response up to 80 kg N/ha was recorded at Saltcoats. Head length also increased as fertilizer N increased up to 80 kg N/ha (Table 5a).

One new trial was established at Star City in 1999 and data were collected in 2000 (Table 6). Significant yield response up to 80-120 kg N/ha was observed, and there were no differences in head percentage and length. Stem percentage declined at 160 kg/ha N or more.

b. Phosphorus

There was no significant yield response to P at three test sites (Tables 7, 8 and 9). However, in 2000, significant yield response up to 40-80 kg P/ha was observed at Saltcoats (Table 7a). On the sandy soil site at Carrot River , there was a trend of yield increase in response to P application (Table 9). There were no differences in any of the other characters measured.

c. Potassium and sulfur

There was no yield response to both K and S (Tables 10, 10a, 11, 12 and 13). There were also no differences in any of the other characters measured.

Weed control

In 1998, no or little injury was observed on seedling timothy sprayed with various herbicides (Table 14). There were no differences in forage and seed yield between the check and herbicide treatments.

In 1999, seedling timothy showed acceptable tolerance 14 days after treatment (14DAT) and 28DAT to all herbicides applied with the exception of Sundance (Table 15). Although Sundance caused significant injury in the seedling timothy, this effect did not reduce forage or seed yields in 2000 (Table 15).

Timothy stands that were established in 1998 and sprayed with herbicides in 1999, showed no symptoms of injury, with the exception of the Ally and Sundance treatments (Table 16). Plots sprayed with Ally recovered by 28 dat, while those sprayed with Sundance continued to show high percentages of injury at 42 dat. A number of the herbicide treatments significantly reduced forage and seed yields compared to the check. The greatest decrease in yield occurred for Sundance, with seed yield being almost negligible (Table 16).

Timothy stands established in 1998 and sprayed in 2000 showed no visible signs of injury for all herbicide treatments at 14 or 28 dat. However, a number of the herbicide treatments significantly reduced forage and seed yields compared to the check. Attain, Curtail M and Prestige at the 2X rates caused the greatest reduction in forage and seed yield. (Table 17)

Summary

-Goliath had highest dry matter yield among the cultivars evaluated and also produced long heads.

-On relatively weed-free fields, timothy established better when seeded without a companion crop. On weedy fields, timothy establishment was superior under companion crops such as canola or peas. Oats appears to be too competitive as a companion crop for timothy.

-Although all trails were established on nutrient deficient soils, yield response was observed only for N fertilizer application. Optimum N rate varied from 40-120 kg/ha, depending on location. There seemed to be a trend of yield response to P on sandy soil at Carrot River site, and the yield response to P was also observed in the second year of production at Saltcoats but these results need to be further confirmed.

-There was little injury when herbicides were sprayed on seedling timothy with the exception of Sundance. These products also had no effect on forage and seed yield the following year. However, on established timothy stands, application of several herbicides caused visible injury and reduced forage and seed yield.

It is very important to note that the above findings were based on one or two years of data, thus, they may not represent long-term effects.

In addition, herbicides used in this study are not registered for use and their use is not recommended by the researchers involved. Use of the these products is entirely at the risk of the producer or company involved.

Table 1. Dry matter yields (kg DM/ha) of timothy varieties evaluated at Melfort, Canora and Saltcoats (tests seeded in 1998 and data collected in 1999 and 2000)

Variety	Melfort 99	Canora S 99	Canora N 99	Saltcoats 99	Canora 00	Mean (% of Drummond)
Bottnia II	9253	5538	3604	6167	6558	6224 (93)
Drummond	8823	7313	4726	6294	6260	6683 (100)
Farol	8679	7326	5466	5243	6038	6550 (98)
Goliath	10648	8356	4099	5907	7085	7219 (108)
Motim	9754	6129	3657	5672	6305	6303 (94)
Timfor	9211	6205	4469	5053	6512	6290 (94)
CV	6.7	9.7	17.6	17.4	5.4	-
$LSD_{0.05}$	1152	1287	NS	NS	529	-

Table 2. Head length (mm) of timothy varieties evaluated at Melfort and Canora (tests seeded in 1998 and date collected in 1999 and 2000).

Variety	Melfort 99	Canora S 99	Canora 00	Mean
Bottnia II	81	101	83	88
Drummond	91	113	86	97
Farol	72	129	74	92
Goliath	93	114	73	93
Motim	88	99	82	90
Timfor	77	82	73	77
CV	9.1	15.4	10.6	-
$LSD_{0.05}$	11.4	24.7	NS	-

Table 3. Dry matter yields, leaf, stem and head percentages, and head length of timothy cv. Drummond established under various companions crops at Buchanan (test seeded in 1998, data collected in 1999).

Treatment	Timothy kg/ha	Leaf Percentage	Stem Percentage	Head Percentage	Head length (mm)
no companion	7619	27	62	11	89
oats ½ green feed	5280	26	62	12	86
oats full green feed	5109	28	61	12	89
oats ½ grain	6473	27	60	13	93
oats full grain	4942	32	56	11	67
canola 1/2	6817	25	64	11	75
canola full	6199	26	66	08	83
peas 1/2	6390	24	64	12	83
peas full	6590	24	63	13	77
CV	9.2	16.2	5.5	19.8	12.9
$LSD_{0.05}$	847	NS	NS	NS	NS

Table 4. Dry matter yields, leaf, stem and head percentages, and head length of timothy cv. Drummond established under various companions crops at Melfort (test seeded in 1999, data collected in 2000).

Treatment	Timothy kg/ha	Leaf Percentage	Stem Percentage	Head Percentage	Head length (mm)
no companion	8670	27	56	17	119
oats ½ green feed	8982	24	61	15	117
oats full green feed	8124	25	59	16	111
oats ½ grain	8023	26	59	15	111
oats full grain	6211	27	58	15	116
canola 1/2	9721	26	60	14	93
canola full	9691	27	57	16	115
peas 1/2	9134	24	60	16	114
peas full	8951	25	57	18	120
CV	6.2	9.1	4.5	17.1	12.5
$LSD_{0.05}$	773	NS	NS	NS	NS

Table 5. Effect of nitrogen application on timothy (cv. Drummond) dry matter yields, leaf, stem and head percentages and head length at Buchanan and Saltcoats (tests seeded in 1998; data collected in 1999).

	Buchanan					Saltcoats				
Treatment	**yield kg/ha**	**leaf %**	**stem %**	**head %**	**head length (mm)**	**yield kg/ha**	**leaf %**	**stem %**	**head %**	**head length (mm)**
0 kg N/ha	4960	20	66	14	73	4872	21	67	13	69
40 kg N/ha	9487	23	66	12	78	5340	21	67	13	77
80 kg N/ha	8709	26	60	13	80	9677	22	63	15	99
120 kg N/ha	8385	26	60	14	93	8835	22	62	16	114
160 kg N/ha	6861	29	58	13	83	8033	25	60	16	83
200 kg N/ha	6706	26	51	23	100	7421	24	62	15	130
CV	16.9	12.8	6.3	23.5	11.7	16.3	10.0	4.4	13.0	28.1
$LSD_{0.05}$	1922	.05	.06	.05	14.9	1835	NS	.04	NS	40.5

Table 5a. Effect of nitrogen application on timothy (cv. Drummond) dry matter yields, leaf, stem and head percentages and head length at Saltcoats (test seeded in 1998; data collected in 2000).

Treatment	**Timothy kg/ha**	**Leaf Percentage**	**Stem Percentage**	**Head Percentage**	**Head length (mm)**
0 kg/ha N	2212	24	62	14	69
40 kg/ha N	5689	23	63	14	77
80 kg/ha N	7972	26	59	16	99
120 kg/ha N	8621	27	55	17	104
160 kg/ha N	8956	31	53	16	109
200 kg/ha N	7701	33	52	15	106
CV	9.8	10.5	5.7	10.5	11.3
$LSD_{0.05}$	1016	4	5	NS	16.0

Table 6. Effect of nitrogen application on timothy (cv. Drummond) dry matter yields, leaf, stem and head percentages and head length in the south of Star City near the Melfort (test seeded in 1999; data collected in 2000).

Treatment	Timothy kg/ha	Leaf Percentage	Stem Percentage	Head Percentage	Head length (mm)
0 kg/ha N	4031	18	67	15	96
40 kg/ha N	6559	18	68	15	118
80 kg/ha N	8018	19	65	16	124
120 kg/ha N	9193	18.6	65	17	122
160 kg/ha N	10186	20.8	61	18	139
200 kg/ha N	8941	21.2	61	18	137
CV	12.0	8.4	3.3	17.1	17.8
$LSD_{0.05}$	1415	2.4	3.2	NS	NS

Table 7. Effect of phosphate application on timothy (cv. Drummond) dry matter yields, leaf, stem and head percentages and head length at Buchanan and Saltcoats (tests seeded in 1998; data collected in 1999).

	Buchanan					Saltcoats				
Treatment	yield kg/ha	leaf %	stem %	head %	head length (mm)	yield kg/ha	leaf %	stem %	head %	head length (mm)
0 kg P/ha	8831	22	61	17	91	8499	22	65	13	101
40 kg P/ha	8547	23	58	19	87	8753	23	62	16	108
80 kg P/ha	8964	23	60	17	89	8587	22	64	14	108
120 kg P/ha	8665	24	57	19	98	8444	24	62	14	112
160 kg P/ha	8565	18	55	26	92	7917	25	61	14	105
200 kg P/ha	8002	24	58	18	88	8187	25	60	15	102
CV	9.1	16.8	4.9	26.3	9.5	5.5	11.0	3.7	13.3	12.4
$LSD_{0.05}$	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 7a. Effect of phosphate application on timothy (cv. Drummond) dry matter yields, leaf, stem and head percentages and head length at Saltcoats (test seeded in 1998; data collected in 2000).

Treatment	Yield kg/ha	Leaf percentage	Stem percentage	Head percentage	Head length (mm)
0 kg P/ha	2588	22	63	15	61
40 kg P/ha	3736	19	66	15	83
80 kg P/ha	4420	19	66	15	82
120 kg P/ha	5571	19	68	13	92
160 kg P/ha	5680	19	69	13	93
200 kg P/ha	6248	18	69	14	89
CV	10.6	10.6	3.2	9.2	10.6
$LSD_{0.05}$	749	NS	NS	NS	13

Table 8. Effect of phosphate application on timothy (cv. Drummond) dry matter yields, leaf, stem and head percentages and head length at Carrot River near the Melfort (test seeded in 1998; data collected in 1999).

Treatment	Yield kg/ha	Leaf percentage	Stem percentage	Head percentage	Head length (mm)
0 kg P/ha	2189	31	57	13	84
25 kg P/ha	2747	27	60	13	84
50 kg P/ha	2685	30	56	14	101
75 kg P/ha	2487	28	57	15	96
100 kg P/ha	3197	30	56	14	95
CV	23.6	10.5	3.4	18.2	9.4
$LSD_{0.05}$	NS	NS	NS	NS	NS

Table 9. Effect of phosphate application on timothy (cv. Drummond) dry matter yields, leaf, stem and head percentages and head length at Carrot River near the Melfort (test seeded in 1998; data collected in 2000).

Treatment	Yield kg/ha	Leaf percentage	Stem percentage	Head percentage	Head length (mm)
0 kg P/ha	6185	22.6	62	15	82
25 kg P/ha	7881	22.4	67	11	82
50 kg P/ha	9157	23.5	62	15	109
75 kg P/ha	8695	22.6	63	15	111
100 kg P/ha	9777	25.9	57	17	97
CV	15.2	7.2	5.2	26.2	14.3
$LSD_{0.05}$	NS	NS	NS	NS	NS

Table 10. Effect of potassium application on timothy (cv. Drummond) dry matter yields, leaf, stem and head percentages and head length at Buchanan and Saltcoats (test seeded in 1998; data collected in 1999).

	Buchanan					Saltcoats				
Treatment	Yield kg/ha	Leaf %	Stem %	Head %	Head length (mm)	Yield kg/ha	Leaf %	Stem %	Head %	Head length (mm)
0 kg K/ha	8528	25	61	14	90	8596	23	59	18	113
10 kg K/ha	7909	27	59	14	85	8479	22	62	16	103
20 kg K/ha	8366	25	60	15	93	7795	23	61	16	98
30 kg K/ha	8150	27	61	13	80	7876	24	59	17	92
CV	7.5	17.1	6.5	9.3	11.2	7.2	8.5	5.5	22.4	10.4
$LSD_{0.05}$	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 10a. Effect of potassium application on timothy (cv. Drummond) dry matter yields, leaf, stem and head percentages and head length at Saltcoats (test seeded in 1998; data collected in 2000).

Treatment	Yield kg/ha	Leaf %	Stem %	Head %	Head length (mm)
0 kg K/ha	2957	28	61	11	68
10 kg K/ha	3070	25	62	13	67
20 kg K/ha	2911	28	60	12	66
30 kg K/ha	3190	26	63	11	68
CV	12.6	6.5	2.5	18.2	8.3
$LSD_{0.05}$	NS	NS	NS	NS	NS

Table 11. Effect of potassium application on timothy (cv. Drummond) dry matter yields, leaf, stem and head percentages and head length at Carrot River near the Melfort (test seeded in 1998; data collected in 1999).

Treatment	Yield kg/ha	Leaf %	Stem %	Head %	Head length (mm)
0 kg K/ha	2879	30	57	13	94
15 kg K/ha	3035	36	53	12	93
30 kg K/ha	3486	35	54	10	95
45 kg K/ha	3470	33	55	12	86
60 kg K/ha	3945	31	57	12	91
75 kg K/ha	2942	34	55	11	94
CV	21.6	10.6	4.5	15.0	12.6
$LSD_{0.05}$	NS	NS	NS	NS	NS

Table 12. Effect of potassium application on timothy (cv. Drummond) dry matter yields, leaf, stem and head percentages and head length at Carrot River near the Melfort (test seeded in 1998; data collected in 2000).

Treatment	Yield kg/ha	Leaf %	Stem %	Head %	Head length (mm)
0 kg K/ha	9099	27	60	13	109
15 kg K/ha	9226	27	58	15	99
30 kg K/ha	9767	29	56	15	106
45 kg K/ha	9992	28	55	17	111
60 kg K/ha	9716	27	56	17	102
75 kg K/ha	9371	26	55	18	105
CV	10.6	7.3	7	21.6	10.5
$LSD_{0.05}$	NS	NS	NS	NS	NS

Table 13. Effect of sulfur application on timothy (cv. Drummond) dry matter yields, leaf, stem and head percentages and head length in the south of Star City near the Melfort (test seeded in 1999; data collected in 2000).

Treatment	Timothy kg/ha	Leaf %	Stem %	Head %	Head length (mm)
0 kg/ha S	8471	21	59	19	124
10 kg/ha S	8972	22	58	20	150
20 kg/ha S	8548	24	57	20	131
30 kg/ha S	8595	23	58	19	133
40 kg/ha S	9622	23	58	20	136
CV	10.2	7.4	3.6	8.4	9
$LSD_{0.05}$	NS	NS	NS	NS	NS

Table 14. Herbicide tolerance in seedling timothy at Melfort (test seeded in 1998; data recorded in 1998 and 1999).

Treatment	%Injury 14 dat*	% Injury 28 dat	Forage yield '98 kg/ha	Forage yield '99 kg/ha	Seed yield '99 kg/ha
Check	0	0	1202	5302	339
Accord 1X	0	0	1054	5424	329
Accord 2X	0	0	968	5374	361
Achieve 1X	0	0	924	5279	337
Achieve 2X	0	0	889	5250	348
Attain 1X	.5	0	932	5503	298
Attain 2X	1.75	0	781	5472	325
Curtail M 1X	0	0	837	5349	366
Curtail M 2X	0	0	804	5365	332
Prestige 1X	0	0	851	5493	353
Prestige 2X	0	0	593	5641	358
Prevail 1X	0	0	870	5391	340
Prevail 2X	0	0	611	5574	320
CV	410	-	36.5	6.8	18.7
$LSD_{0.05}$	NS	NS	NS	NS	NS

*dat = Days after treatment.

Table 15. Herbicide tolerance in seedling timothy at Melfort (test seeded in 1999; data recorded in 1999 and 2000).

Treatment	1999 % Injury 14dat*	1999 % Injury 28dat	2000 Forage kg/ha	2000 Seed kg/ha	2000 Leaf %	2000 Stem %	2000 Head %	2000 Head length (mm)
Check	0	0	6262	832	24	63	13	137
Accord 1X	0	0	6957	823	28	56	16	128
Accord 2X	0	0	6230	895	31	52	18	121
Ally+Agral 90	13	0	7210	857	26	54	20	118
Attain 1X	0	0	7695	824	29	54	18	125
Attain 2X	0	0	8017	837	31	54	15	127
Clopyralid +MCPA 1X	0	0	6458	933	26	54	19	117
Clopyralid +MCPA 2X	0	0	7555	722	29	52	19	114
Curtail M 1X	0	0	7993	816	28	55	17	137
Curtail M 2X	0	0	6292	681	26	56	17	119
Fluroxypyr +MCPA 1X	2.5	0	6615	779	28	54	18	140
Fluroxypyr +MCPA 2X	0	0	7453	766	25	57	18	132
Prestige 1X	0	0	6736	829	28	57	15	107
Prestige 2X	0	0	6404	716	30	57	14	125
Sundance 1X	95	96	6081	830	26	54	19	127
CV	39	16.4	23.6	15.3	14.7	8.3	21.3	11.2
$LSD_{0.05}$	4.08	1.49	NS	NS	NS	NS	NS	NS

*dat = Days after treatment.

Table 16. Herbicide tolerance in established timothy at Melfort (test seeded in 1998 and data recorded in 1999).

Treatment	% Injury 14 dat*	% Injury 42 dat	Forage yield '99 kg/ha	Seed yield '99 kg/ha
Check	0	0	6072	339
Attain 1X	0	0	5667	297
Attain 2X	0	0	5266	219
Prestige 1X	0	0	5480	254
Prestige 2X	0	0	5380	181
Curtail M 1X	0	0	5302	224
Curtail M 2X	0	0	5885	182
Buctril M 1X	0	0	6102	292
Buctril M 2X	0	0	5612	240
Fluroxypyr & MCPA 1X	0	0	5524	280
Fluroxypyr & MCPA 2X	0	0	5640	212
Clopyralid & MCPA A 1X	0	0	5462	280
Clopyralid & MCPA A 2X	0	0	5573	226
Ally 1X	28	0	5688	249
Sundance 1X	80	93	4480	24
CV	34.4	12.0	7.6	17.6
$LSD_{0.05}$	3.5	1.1	608	59

*dat = Days after treatment.

Table 17. Herbicide tolerance in established timothy at Melfort (test seeded in 1998 and data recorded in 2000).

Treatment	1999 %Injury 14 dat*	1999 %Injury 28 dat	2000 Forage kg/ha	2000 Seed kg/ha	2000 Leaf %	2000 Stem %	2000 Head %	2000 Head length (mm)
Check	0	0	7468	582	23.4	61.3	15.3	44
Attain 1X	0	0	6702	572	21.3	63.3	15.4	48
Attain 2X	0	0	6590	459	22.8	63.2	14.1	50
Prestige 1X	0	0	6867	564	22.2	61.4	16.4	48
Prestige 2X	0	0	7112	512	23	63.9	13.1	46
Curtail M 1X	0	0	7226	564	23	60.7	16.3	53
Curtail M 2X	0	0	6150	491	21.5	60.8	17.8	43
Buctril M 1X	0	0	6919	578	22.9	62.9	14.2	43
Buctril M 2X	0	0	6539	548	20.7	63.1	16.2	44
Fluroxypyr & MCPA 1X	0	0	6817	582	22.4	64.1	13.5	48
Fluroxypyr & MCPA 2X	0	0	6970	576	24.2	61.5	14.4	52
Clopyralid & MCPA A 1X	0	0	7132	552	22.1	61.6	16.3	49
Clopyralid & MCPA A 2X	0	0	6564	539	22.5	63.5	13.9	50
Ally 1X	0	0	6662	559	20	63.2	16.8	52
CV	-	-	6	8.2	12.8	3	16.8	16.8
$LSD_{0.05}$	-	-	589.3	64.5	NS	NS	NS	NS

*dat = Days after treatment.

Timothy Hay Field Day
July 10, 2000

Touring of Fertility Trials

Ag Shield Reconditioner Demonstration